Factors influencing participation in illegal mining in Ghana: A case of Denkyira Corridor

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FACTORS INFLUENCING PARTICIPATION IN ILLEGAL MINING IN GHANA: A CASE OF DENKYIRA CORRIDOR.

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Abstract

Illegal mining is not only dangerous to human life but the other living organisms which support human existence, thus, in turn destroying the ecosystem. Galamsey activities are responsible for deforestation and soil erosion in most of the mining communities which Denkyira corridor is no exception. This study therefore investigated factors that influence ones decision to participate in illegal mining in Denkyira corridor. Snowball and purposive sampling techniques were used to select 160 respondents and binary probit model was used to identify the factors that influence ones decision to participate in illegal mining in the study area.

The study found that household size, Age, sex, Educational attainment, perceived risk and peer influence are key predictors of ones decision to participate in illegal mining in Denkyira corridor. On this basis, it is recommended that there should be mass education on the negative effects of illegal mining and this education should focus on males, household heads and youth.

Keywords: determinants**,** Illegal mining and binary probit model

INTRODUCTION

Small scale mining is define as mining by any method not involving substantial expenditure by any individual or group of persons not exceeding nine in number or by a cooperative society made up of ten or more persons (Government of Ghana, 1989). Small scale mining was legalized by the government of Ghana by lifting the ban on small scale mining in 1989. This was done by passing the Small-Scale Gold Mining Law, Mercury Law, Precious Minerals and Marketing Law (Hilson, 2008). Small scale miners companies are required to secure a small-scale gold mining license, which permits them to work legally on a demarcated plot of land approved by the government and this process. This process which made registered small-scale mining companies legally bound, ensured that they operate within a certain code of ethics, the breach of which attracts commensurate sanctions (Nsohbono, 2013).

Although small scale gold miners require mining license before they can operate, it can be said that more than half of small scale mining business are operating without a legal license. According to Ghana academy of arts and sciences (2003), Small scale mining businesses are estimated to number over 150,000 in Ghana, of which many operate illegally on concessions belonging to large scale operators, or in restricted areas. This illegal small scale mining is generally known in Ghana as Galamsey. Since galamsey is illegal it is difficult to ensure they operate within code of ethics and even control their activities. This illegal mining has created environmental problems. The principal environmental problems caused by small-scale mining activities are mercury pollution from gold processing and land degradation (World Bank, 1995). Rivers and other water bodies that served as a source of drinking water for communities in mining areas have been polluted which lead to ill health of people. The pollution is not only dangerous to human life but the other living organisms

which support human existence, thus, in turn destroying the ecosystem. Galamsey activities are responsible for deforestation and soil erosion in most of the mining communities.

To solve these problems caused by illegal mining, the government of Ghana was determined to adopt measures to keep illegal miners at bay (Daily Graphic, 2014). The government of Ghana in order to keep illegal miners at bay has employed the services of security services such as the Police and Military to help control the mounting illegal mining activities (galamsay activities) in Ghana. The employment of this special security Task force has also resulted to a lot of problems. For instance, two naval officers chasing illegal miners, who have been polluting the Pra River, got drowned in the river. Also death of illegal miners caused by a collapse cave or them being buried alive in collapse pits have been increased. Though the risk to life and environment poses by illegal mining is equally high yet small scale mining activities continued in the country. The question that we need to find answer to is why illegal mining activities is increasing despite the government intervention and even the risk it posses to life and environment? Although many researchers have researched in the area of illegal mining, none of the researchers have looked into factors that influence individuals' decision to participate in illegal mining. The purpose of this study is to examine factors that influence individual's decision to participate in illegal mining in Denkyira corridor in Central region of Ghana, which is one of the areas badly affected by the activities of small scale gold mining.

METHODOLOGY

Study Area.

The Denkyira geographical corridor has two administrative districts namely, Upper Denkyira and Lower Denkyira. The corridor has its foundation on the Birimian and Tarkwaian rock formations (Hilson, 2001 as cited in kessey and Arko, 2012). The area is located in forest-dissected plateau, rising to about 250 metres above sea level. The corridor is

drained by two rivers, the Offin and Bia. According to Hilson (2001), the former contains large amounts of placer gold deposits. The region falls within the semi equatorial zone with two rainfall regimes, and total annual mean rainfall between 120centimetres and 200 centimetres. Intensive small scale gold mining activities by licensed operators take place mainly during the dry season as they have relatively sophisticated equipment while the unlicensed miners operate mainly in the wet season with rudimentary tools. The local economy of the corridor is dominated by the agricultural sector. Besides agriculture which employs over 70 percent of the population, the small scale gold mining industry is the next biggest employer. The industry holds the economy of the corridor together as other economic activities such as commerce; manufacturing and household businesses depend on it. The office of the Minerals Commission, Environmental Protection Agency and other public institutions for the Denkyira corridor are located at Dunkwa-on-Offin.

Sample and sampling technique

Simple random sampling technique was employed in selecting four communities from the study Area namely; Akropong, Kyekyewera, Ayenfude and Boabinso. Snowball sampling technique was used to select people who participate in galamsey and purposive sampling was also used to select those who do not participate in galamsey from each community. Interview schedule was used to collect data from the respondents and in all, 160 respondents were interviewed. Since most of the galamsey activities are illegal it was impossible to get a large sample size. Interview schedule was considered to be suitable because some of the respondents were illiterates.

Also, the researcher was helped by five (5) research assistants. The research assistants were taken through the process and mechanism of interviewing to obtain the right response from the respondents in order to achieve the objective of the study. The research assistants

who were involved in the data collection were chosen base on their educational background, proficiency in the Twi language and their ability to translate from English to Twi.

The Probit Model

Binary probit and logit models are commonly used models when the dependent variable is dichotomous. Since the substantive results generated by Binary probit and logit models are indistinguishable the researchers choose to use the binary probit model for this study. The probit model assumes that while we only observe the values of 0 and 1 for the variable participation in illegal mining (Y), there is a latent, unobserved continuous variable Y^* that determines the value of Y. We assume that Y^* can be specified as follows:

$$Y^* = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + ... + \beta_k x_k + u_i .....(1)$$

And that: $Y_i = 1$ if $Y_i^* > 0$ (ith individual participate in galamsey)

$Y_i = 0$ otherwise (ith individual does not participate in galamsey).

where $x_1, x_2, ..., x_k$ represent vectors of random variables, $[\beta_0, \beta_i]$ are the intercept and slope parameters to be estimated and u represents a random disturbance term. The stochastic error term component captures errors in model specification including omission of relevant variables and errors in data measurement.

From equation (1) the probability that the i^{th} individual will participate in galamsey is

$\Pr(Y_i = 1) = \Pr(\beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + ... + \beta_k x_k + u_i > 0)$ ……..(2)

However, to determine the probability that ith individual will participate in galamsey, the empirical model for binary probit model to be estimated is specified as follows:

$$pr(Y_i = 1) = \beta_0 + \beta_1 sex_i + \beta_2 age_i + \beta_3 educlevel_i + \beta_4 peers_i + \beta_5 marital_i + \beta_6 riskness_i + \beta_7 householdsize_i + \varepsilon_i .....(3)$$

where:, sex is the ith individual gender, educlevel is educational attainment of the individual, riskiness is the individual's perception about the riskiness of galamsey, age is age of the respondent, marital refers to marital status of the respondent and peers refers to number of respondent's friends in galamsey and householdsize refers to the household size of the respondent.

Results and Discussions

The analysis is divided into two main parts, the first covering the descriptive statistics while the second touches on the regression analysis. The findings are presented in the form of tables and regression analysis. The total sample sizes taken for the survey is 160 respondents and out of these 160 respondents 90 of them were galamsey workers and 70 of them have not participated in galamsey before.

Table 1: Distribution of respondents according to galamsey participation status

	Female		Male	
Galamsey	Frequency	Percent	Frequency	Percent
Galamsey worker	25	15.62	65	40.63
Not a galamsey worker	40	25	30	18.75
Total	65	40.62	95	59.38

Source: Author's construct 2015

Table 1 above shows that most of the respondents used for this study were males. Thus 95 respondents representing 59.38% were male and the remaining 65 respondents representing 40.62% were females. Also from above table we can see that majority of the people who engage in galamsey are males. The table indicates that out of the 65 female respondents used

for the study, only 25 of them were galamsey workers and 40 have not participated in galamsey activities. The story was different for the males. That is 65 males representing 40.63% have engaged in galamsey activities and 30 of them have not participated in galamsey activities.

The study revealed that most of the respondents used for this study have had formal education. Out of the 160 respondents, 60 representing 37.5% have had no formal education, 55 representing 34.38% have had primary education, 30 representing 18.75% have had junior or senior high school education and 15 respondents representing 9.37 have had tertiary education.

The study also looked at the stages of galamsey activities that the respondents were mostly involved in. The study revealed that out of the 90 respondents who were galamsey workers, 40 of them representing 44.44% were involved in extracting, grinding and washing of stones and all the 40 respondents who involved in these three activities were males. Also, 10 respondents 11.11% were involved in extracting and gold panning, 25 representing 27.77% indicated that they transported water and minerals from the galamsey pit and the remaining 15 representing 16.66% involved in washing of gold stones and transporting minerals and water. The study found that none of the females were involved in extracting and grinding of stones and very few males (10) were involved in only gold panning and transporting mineral and water from the pit.

There was the need to look at the effect of galamsey on the communities. The Table 2 below shows that all the respondents agreed that apart from income it generates to workers, galamsey has negative effects on their communities. Fifty respondents said that galamsey has destroyed both their water bodies and vegetation in their communities. 10 respondents said it has destroyed water bodies and increased child labour in the area and 100 respondents said it has destroyed water bodies, vegetation and increased child labour in the area. This shows that

majority of the respondents agreed that galamsey activities destroy water bodies, vegetation and increased child labour. The study further looked at whether galamsey should be banned in Ghana due to it negative effects on communities. Out of the 160 respondents, 70 of them said that galamsey should be banned and 90 of them said it should not be banned but the government can come out laws to regulate galamsey.

Table 2: Effects of Illegal Mining on the communities.

effects	Frequency	Percent
destroys water bodies, vegetation and increases child labour	100	62.5
Destroys water bodies and vegetation	50	31.25
destroys water bodies and increases child labour	10	6.25
Total	160	100.00

Source: Author's construct 2015

Factors Influencing Ones' decision to participate in Galamsey

The study used equation (3) to estimate factors that influence an individual's decision to participate in illegal mining (galamsey). The dependent variable for this part of this study was decision to participate.

Probit equation in the previous section was estimated to determine the probability of an individual participating in galamsey (illegal mining). The decision of an individual to be participated or not is hypothesised to depend on a number of demographic characteristics and other factors. These demographic characteristics include age of an individual, sex,

individual's level of education and marital status. The other factors that influence individual's decision to participate in galamsey include individual's household size, risk, and peer influence. The result of the probit estimation is shown in Table 3.

Table 3: Probit estimation for determinants of individuals' participation in galamsey

Variable	Coef.	Robust Std. Err	z	P>z
sex	0.737676	0.2520161	2.93	0.003
age	-0.0488	0.0145848	-3.35	0.001
housesize	0.286172	0.076473	3.74	0.000
Educational attainment				
Basic	-0.52598	0.338678	-1.55	0.120
Secondary	-0.5107	0.3416081	-1.49	0.135
Technical	1.040239	0.4194139	2.48	0.013
Tertiary	-0.92881	0.4543398	-2.04	0.041
marital	0.010831	0.2698395	0.04	0.968
risk	-0.8368	0.2452553	-3.41	0.001
Peers	0.080461	0.0299015	2.69	0.007
_cons	0.667025	0.5124638	1.3	0.193

Number of obs = 160; Wald chi2(10) = 58.24

Prob > chi2 = 0.0000; Log pseudolikelihood = -68.079028

Pseudo R2 = 0.3653; Hosmer-Lemeshow: Prob>Chi2(8) =0.0774

Linktest: _hat P>|Z|=0.000; _hatsq P>|Z|=0.740; VIF=1.11

In all, a cross section of 160 individuals was used in this study and the Wald test statistic of the estimated model is significant at one (1) percent level. This suggests that the explanatory variables taken together influence or explains individual's decision to participate in galamsey. The McFadden (pseudo) R2 is an indication of the goodness of fit of the model though it is not as important as statistical significance of the independent variables (Wooldridge, 2005). It has the value of 0.3653. Sonka and Hornbaker (as cited in Mishra & Perry, 1999) indicate that a lower and upper bound R2 for goodness of fit in favour of binary choice models range from 0.20 to 0.40, thus a Pseudo R2 of 0.3653 indicates a good fit. Hosmer- Lemeshow test for goodness-of-fit and linktest were also passed. Using a group of ten, an individual's decision to participate in galamsey had a Hosmer-Lemeshow chi square of 14.17 with probability of 0.0774. A *p*-value of the _hatsq (*p*-value =0.740) is not significant so the null hypothesis that there is no specification error in the model is accepted. Thus the model for this study was correctly specified and no additional predictors can be found to be statistically significant except by chance.

Since probit output is nonlinear, the parameter estimates were transformed into marginal effects to give the magnitude of the change in the probability of participating in illegal mining (galamsey) when the explanatory variable changes by one (1) unit. Table 4 shows the marginal effects of the predictor variables.

Table 4: **Marginal effect of determinants of individual's participation in illegal mining**

Variable	Marginal effect	Std.Err.	P>z
sex	0.175	0.05742	0.002**
age	-0.0116	0 .00313	0.000**
House size	0.068	0.01538	0.000**
Education Attainment			
Basic	-0.137	0.08608	0.112
Secondary	-0.133	0.08733	0.127
Technical	0 .277	0.10420	0.008**
Tertiary	-0.226	0.10004	0.024*
Marital Status	0 .003	0.064215	0.968
risk	-0.199	0.05247	0.000**
Peers	0 .019	0.00663	0.004**

*P<0.05; **P<0.01

From Table 4, the marginal effect of sex of the individual is statistically significant at 1 percent level (p-value=0.002). Therefore, this study rejected the null hypothesis that sex of person does not have effect on a decision to participate in illegal mining and accepted that sex of an individual has effect on illegal mining. Sex (male dummy) of the individual has a positive correlation with participation in illegal mining. Males are more likely to participate in illegal mining than female. The probability of a male compared to a female participating in illegal mining increases by 17.55 percent at five percent level of significance. This can be attributed to the fact that generally males like risk taking than females. This finding corroborate the findings of Kessey, & Arko (2012) and Adjei, Oladejo &

Adetunde **(**2012). Kessey, & Arko (2012) found that small scale gold mining is a male dominated enterprise because the male licensed miners used in their study were 82 percent as compared to 18 percent female licensed miners.

Age of the individual is significant in explaining the probability of an individual participating in illegal mining. It is significant at 1% level (p-value=0.000) and has a negative correlation with probability of being engaged in illegal mining. Therefore, this study rejected the null hypothesis that age of an individual does not have effect on a decision to participate in illegal mining and accepted that age of an individual has effect on illegal mining. The negative coefficient of age of the individual implies that the probability of an individual participating in illegal mining decreases as his age increases. Thus the marginal effect of -0.0116 indicates that when an individual attains one additional year, the probability of that individual engaging in illegal mining decreases by 1.16 percent. This result is consistent with the findings of Adjei, Oladejo & Adetunde **(**2012) that says galamsey operation is for the youth and others jobs are for the elderly in the community. This is true because the youth are the one with much strength to work on the rocks.

The study found that household size has influence on ones decision to participate in illegal mining. Household size was significant at 1% level (p-value=0.000) and had a positive correlation with probability of an individual partcipating in illegal mining. Therefore, this study rejected the null hypothesis that the size of an individual's household does not have effect on ones decision to participate in illegal mining and accepted that the size of an individual's household has effect on ones decision to participate in illegal mining. The positive coefficient of household size of the individual implies that the probability of an individual participating in illegal mining increases as the size of his/her household size increases. Thus the marginal effect of .0681 indicates that a unit increase in the size of an

individual's household size increases the probability of that individual engaging in illegal mining increases by 6.81 percent.

With regards to individual's educational attainment, the study found that educational attainment of an individual has effect on the probability of the individual participating in illegal mining. Two of the four dummy variables of individuals' educational attainment were statistically significant namely, Technical and Tertiary Education. The marginal effect of an individual with technical education is statistically significant at 1 percent level and possesses a positive sign. The implication is that those individuals with technical education are more likely to be engaged in illegal mining as compared with individual with no formal education.

The marginal effect of 0.2770 indicates that the probability of an individual with technical education being participated in illegal mining as compared to an individual with no formal education increases by 27.70 percent. For those individuals with tertiary education, the marginal effect has a negative sign and is also significant at 5 percent level. This indicates that individuals with tertiary education are less probable to be engaged in illegal mining. The marginal effect of .2266 suggests that the probability of an individual with tertiary education being engaged in illegal mining as compared to an individual with no formal education decreases by 22.66 percent.

The marginal effect of individual's perception about the risk in illegal mining is statistically significant at 1 percent level and possesses a negative sign. Hence, the study rejected the null hypothesis that the individual's perception about the risk in illegal mining does not have effect on ones decision to participate in illegal mining and accepted that the individual's perception about the risk in illegal mining has effect on ones decision to participate in illegal mining. The negative coefficient of individual's perception about the risk in illegal mining implies that as an individual perceives participation in illegal mining to be

risky, the probability of that individual participating in illegal mining decreases. The marginal effect of individual's perception about the risk in illegal mining is -0.1991and implies that the probability of an individual who perceives participation in illegal mining to be risky participating in illegal mining as compared to an individual who does not perceive participation in illegal mining to be risky decreases by 19.91 percent.

The result in Table 4 also depicts that peer influence (the number of friends of an individual in illegal mining) significantly explains ones decision to participate in illegal mining. Peer influence is significant at 1% level (p-value=0.004) and has a positive correlation with probability of an individual participating in illegal mining. Therefore, this study rejected the null hypothesis that peer influence does not have effect on an individual's decision to participate in illegal mining and accepted that peer influence has effect on illegal mining. The positive coefficient of peer influence implies that the probability of an individual participating in illegal mining increases as the number of his/her friends who are into illegal mining increases. Thus the marginal effect of .0191 indicates that as the number of individual's friends who are into illegal mining increases, the probability of that individual engaging in illegal mining increases by 1.191 percent.

Conclusion and recommendation

Based on the findings of this study, it can be concluded that household size, Age, sex, Educational attainment, perceived risk and peer influence are key predictors of individual's decision to participate in illegal mining in Denkyira corridor in Ghana. On this basis, it is recommended that there should be mass education on the negative effects of illegal mining and this education should focus on males, household heads and youth.

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